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Lake De Smet, Johnson County, Wyoming

National Eutrophication Survey, Corvallis, Oreg

Prepared for

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Jul 77

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NATIONAL EUTROPHICATION SURVEY

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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REPORT
ON
LAKE DE SMET
JOHNSON COUNTY
WYOMING

EPA REGION VIII

WORKING PAPER NO. 884

WITH THE COOPERATION OF THE

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY

AND THE

WYOMING NATIONAL GUARD

JULY, 1977

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Wyoming Department of Environmental Quality for professional involvement, to the Wyoming National Guard for conducting the tributary sampling phase of the Survey, and to those Wyoming wastewater treatment plant operators who voluntarily provided effluent samples.

The staff of the Water Quality Division provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

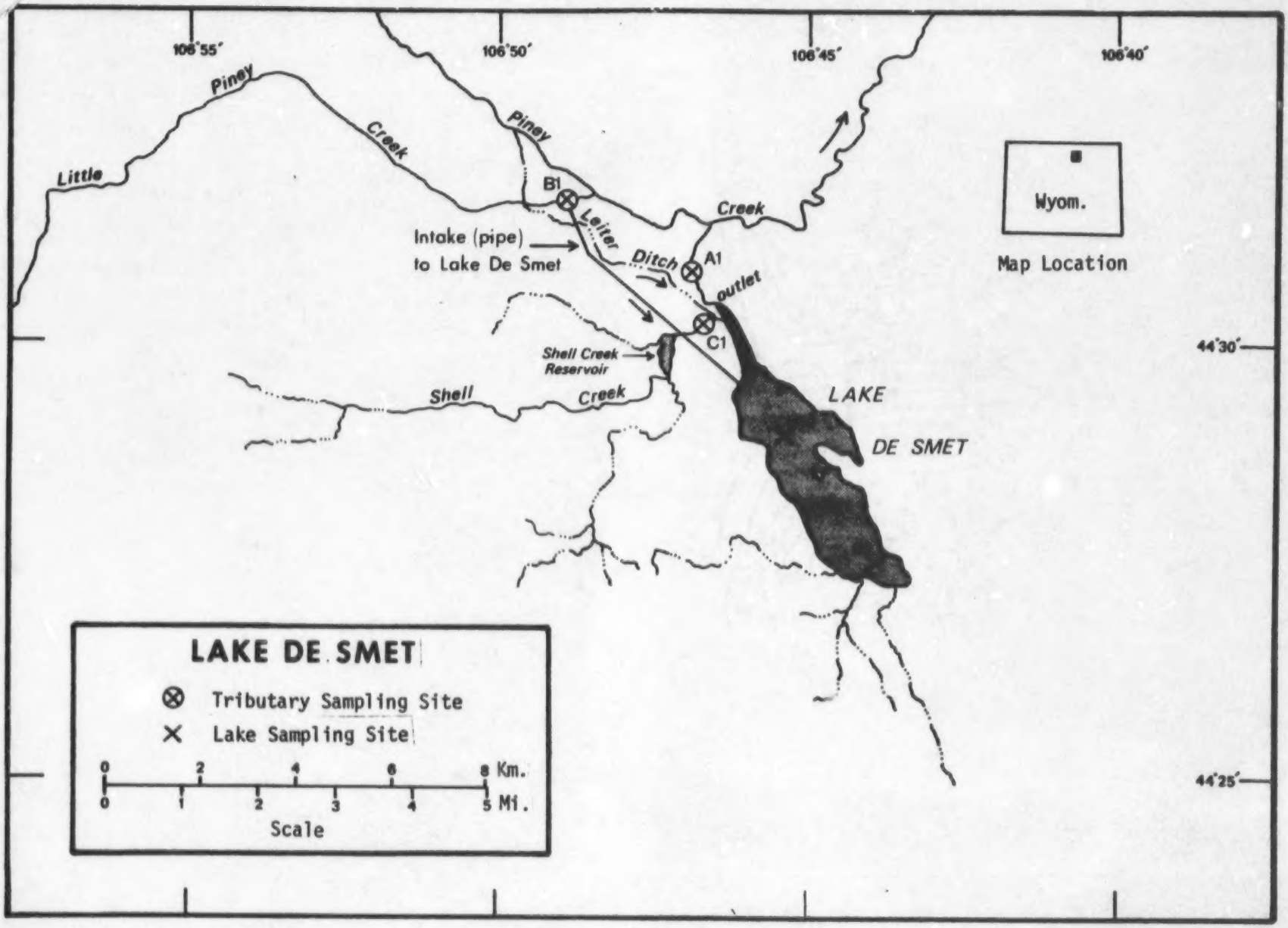
Brigadier General James L. Spence, The Adjutant General of Wyoming, and Project Officer Colonel Donald L. Boyer, who directed the volunteer efforts of the Wyoming National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY RESERVOIRS

State of Wyoming

NAME	COUNTY
Big Sandy	Sublette, Sweetwater
Boulder	Sublette
Boysen	Fremont
De Smet	Johnson
Flaming Gorge	Sweetwater, WY; Daggett, UT
Fremont	Sublette
Glendo	Converse, Platte
Keyhole	Crook
Ocean	Fremont
Seminoe	Carbon
Soda	Sublette
Viva Naughton	Lincoln
Woodruff Narrows	Uinta
Yellowtail	Bighorn, WY; Bighorn, Carbon, MT


106°55′
106°50′
106°45′
106°40′
Piney
Creek
Piney
Creek
Little
B1
Leiter
Ditch
Creek
Intake (pipe)
to Lake De Smet
A1
outlet
C1
Shell Creek
Reservoir
Shell
Creek
LAKE
DE SMET
Wyom.
Map Location
44°30′
44°25′
LAKE DE SMET
Tributary Sampling Site
Lake Sampling Site
0 2 4 6 8 Km.
0 1 2 3 4 5 Mi.
Scale

LAKE De SMET

STORET NO. 5604

I. INTRODUCTION

When completed, the dam construction underway during the Survey sampling year will raise the level of Lake De Smet about 12 meters and will more than double the storage capacity (Mueller, 1974). Also, because of the construction, no water was diverted to the lake from Piney Creek and Little Piney Creek during the year (Kavolock, 1976). Consequently, the data presented in this report essentially are of little management significance since it is unlikely the data will be representative of conditions in the enlarged lake with normal stream diversions.

II. CONCLUSIONS

A. Trophic Condition:

The Survey data indicate Lake De Smet was mesoeutrophic during the sampling year. It ranked sixth in overall trophic quality when the 14 Wyoming lakes and reservoirs sampled in 1975 were compared using a combination of six parameters*. Six of the water bodies had less median total phosphorus, five had less median orthophosphorus, none had less but four had the same median inorganic nitrogen, 11 had less mean chlorophyll a, and five had greater mean Secchi disc transparency. No significant depression of dissolved oxygen with depth occurred at any of the sampling times.

Survey limnologists observed an algal bloom in progress throughout the lake in October.

* See Appendix A.

B. Rate-Limiting Nutrient:

Because of nutrient changes in the samples during shipment from the field to the laboratory, the algal assay results are not considered representative of conditions in the lake at the times the samples were taken. The lake data indicate nitrogen limitation at all sampling times.

C. Nutrient Controllability:

1. Point sources--No known municipal or industrial wastewater treatment plants impacted Lake De Smet during the sampling year. Septic tanks serving lakeshore dwellings were estimated to have contributed 0.7% of the total load, but a shoreline survey would be necessary to determine the significance of those sources.

The estimated phosphorus loading of 0.07 g/m^2 during the sampling year is a little less than that proposed by Vollenweider (Vollenweider and Dillon, 1974) as an oligotrophic loading. However, the loading probably is considerably greater when water is diverted to the lake from Piney and Little Piney creeks.

2. Non-point sources--It is estimated that non-point sources, including precipitation, contributed 99.3% of the total phosphorus load to the lake during the sampling year.

III. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Morphometry††:

1. Surface area: 10.74 kilometers^2.
2. Mean depth: 12.8 meters.
3. Maximum depth: >16.5 meters.
4. Volume: 137.937 x 10^6 m^3.
5. Mean hydraulic retention time: Unknown.

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
None (no diversions during sampling year)	-	-
Minor tributaries & immediate drainage -	15.2	0.167
Totals	15.2	0.167

2. Outlet -

Piney Creek	25.9**	0.323**

C. Precipitation***:

1. Year of sampling: 45.2 centimeters.
2. Mean annual: 42.3 centimeters.

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† Table of metric conversions--Appendix B.
†† During sampling year (Mueller, op. cit.).
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake; lake level lowered during sampling year.
*** See Working Paper No. 175.

IV. WATER QUALITY SUMMARY

Lake De Smet was sampled three times during the open-water season of 1975 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at two stations on the lake (see map, page v). During each visit, a single depth-integrated (4.6 m to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first and last visits, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 12.5 meters at station 1 and 16.5 meters at station 2.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR LAKE DE SMET
STORET CODE 5604

PARAMETER	1ST SAMPLING (5/22/75) 2 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (-8/29/75) 2 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (10/15/75) 2 SITES RANGE	MEAN	MEDIAN
TEMP (C)	6.1 - 7.8	7.0	6.9	19.0 - 20.3	19.6	19.5	12.1 - 12.6	12.4	12.4
DISS OXY (MG/L)	9.2 - 10.0	9.5	9.5	5.6 - 8.2	7.3	7.6	7.8 - 10.0	8.7	8.6
CNDCTVY (MCROMO)	530. - 560.	542.	540.	712. - 732.	720.	718.	612. - 637.	629.	631.
PH (STAND UNITS)	8.5 - 8.6	8.6	8.6	8.4 - 8.6	8.5	8.6	8.6 - 8.6	8.6	8.6
TOT ALK (MG/L)	169. - 172.	170.	170.	162. - 170.	166.	165.	160. - 176.	165.	163.
TOT P (MG/L)	0.022 - 0.040	0.032	0.030	0.027 - 0.040	0.033	0.032	0.026 - 0.074	0.044	0.037
ORTHO P (MG/L)	0.004 - 0.015	0.010	0.012	0.005 - 0.021	0.010	0.009	0.003 - 0.006	0.004	0.004
NO2+NO3 (MG/L)	0.020 - 0.020	0.020	0.020	0.020 - 0.020	0.020	0.020	0.020 - 0.020	0.020	0.020
AMMONIA (MG/L)	0.020 - 0.030	0.025	0.025	0.020 - 0.060	0.027	0.020	0.020 - 0.060	0.031	0.030
KJEL N (MG/L)	0.500 - 0.700	0.590	0.600	0.400 - 0.500	0.412	0.400	0.400 - 0.600	0.544	0.600
INORG N (MG/L)	0.040 - 0.050	0.045	0.045	0.040 - 0.080	0.047	0.040	0.040 - 0.080	0.051	0.050
TOTAL N (MG/L)	0.520 - 0.720	0.610	0.620	0.420 - 0.520	0.432	0.420	0.420 - 0.620	0.564	0.620
CHLRPYL A (UG/L)	4.7 - 4.8	4.7	4.7	9.4 - 10.7	10.0	10.0	16.0 - 21.4	18.7	18.7
SECCHI (METERS)	3.4 - 3.5	3.4	3.4	1.2 - 1.5	1.4	1.4	1.8 - 2.4	2.1	2.1

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
05/22/75	1. Centric diatoms	5,052
	2. Fragilaria sp.	1,160
	3. Diatoma sp.	414
	4. Stephanodiscus sp.	373
	5. Flagellates	124
	Other genera	165
	Total	7,288
08/29/75	1. Melosira sp.	1,749
	2. Flagellates	875
	3. Aphanizomenon sp.	807
	4. Anabaena sp.	673
	5. Microcystis sp.	673
	Other genera	807
	Total	5,584
10/15/75	1. Aphanizomenon sp.	2,338
	2. Chroomonas (?) sp.	984
	3. Cryptomonas sp.	287
	4. Anabaena sp.	123
	5. Sphaerocystis sp.	41
	Total	3,773

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
05/22/75	1	4.8
	2	4.7
08/29/75	1	9.4
	2	10.7
10/15/75	1	21.4
	2	16.0

C. Limiting Nutrient Study:

Due to significant changes in nutrients from the time of sample collection to the beginning of the assays, the algal assay results are not considered representative of conditions in the lake at the times the samples were taken (05/22/75 and 10/15/75).

The lake data indicate that Lake De Smet was nitrogen limited all three sampling times. The mean inorganic nitrogen to ortho-phosphorus ratios were 5 to 1 in May, 5 to 1 in August, and 13 to 1 in October; and nitrogen limitation would be expected.

V. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Wyoming National Guard collected monthly near-surface grab samples when possible from each of the tributary sites indicated on the map (page v). Sampling was begun in October, 1974, and was completed in September, 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Wyoming District Office of the U.S. Geological Survey for the outlet and the minor tributaries and immediate drainage. No diversions to the lake from Piney and Little Piney creeks were made during the sampling year.

Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the mean concentrations in Shell Creek at station C-1 and the mean annual ZZ flow.

No known wastewater treatment plants impacted Lake De Smet during the sampling year.

A. Waste Sources:

1. Known municipal - None
2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/yr	% of total
a. Tributaries (non-point load) -		
None	-	-
b. Minor tributaries & immediate drainage (non-point load)	580	74.8
c. Known municipal STP's -	None	-
d. Septic tanks* -	5	0.7
e. Known industrial -	None	-
f. Direct precipitation** -	190	24.5
Total	775	100.0

2. Outputs -

Lake outlet - Piney Creek 1,030

3. Net annual P loss - 255 kg.

D. Mean Nutrient Concentrations in Ungaged Streams:

Tributary	Mean Total P Conc. (mg/l)	Mean Total N Conc. (mg/l)
Little Piney Creek diversion	0.025	0.680
Shell Creek	0.110	1.230

* Estimate based on 20 lakeshore dwellings; see Working Paper No. 175.
** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
None -	-	-
b. Minor tributaries & immediate drainage (non-point load) -	6,480	35.4
c. Known municipal STP's -	None	-
d. Septic tanks* -	215	1.2
e. Known industrial -	None	-
f. Direct precipitation** -	11,595	63.4
Total	18,290	100.0

2. Outputs -

Lake outlet - Piney Creek	11,835

3. Net annual N accumulation - 6,455 kg.

D. Mean Nutrient Concentrations in Ungaged Streams:

Tributary	Mean Total P Conc. (mg/l)	Mean Total N Conc. (mg/l)
Little Piney Creek diversion	0.025	0.680
Shell Creek	0.110	1.230

* Estimate based on 20 lakeshore dwellings; see Working Paper No. 175.
** See Working Paper No. 175.

E. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	0.07	loss*	1.7	0.6

Vollenweider phosphorus loadings ($g/m^2/yr$) based on surface area and outflow of Lake De Smet during the sampling year:

"Dangerous" (eutrophic loading)	0.20
"Permissible" (oligotrophic loading)	0.10

* The loss of phosphorus probably was the result of the lowering of the level of the lake during the sampling year.

VI. LITERATURE REVIEWED

Kavolock, Paul, 1976. Personal communication (diversions from Little Piney and Piney Creeks). WY State Hydrologist, Sheridan.

Mueller, John W., 1974. Lake De Smet enlargement and Healy Reservoir site, Johnson County. Adm. Rept., Proj. 3074-09-6701, WY Game & Fish Dept., Cheyenne.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
5601	BIG SANDY RESERVOIR	0.087	0.060	487.667	4.383	8.800	0.020
5602	BOULDER LAKE	0.008	0.040	361.800	2.483	8.400	0.002
5603	BOYSEN RESERVOIR	0.037	0.140	465.923	6.264	14.400	0.014
5604	LAKE DE SMET	0.033	0.040	409.000	11.167	9.400	0.006
5605	FLAMING GORGE RESERVOIR	0.014	0.605	366.461	5.611	12.200	0.003
5606	FREMONT LAKE	0.006	0.040	-22.000	3.783	7.400	0.002
5607	GLENDO RESERVOIR	0.045	0.315	459.182	8.473	12.600	0.014
5608	KEY HOLE RESERVOIR	0.028	0.050	454.583	7.792	14.000	0.004
5609	OCEAN LAKE	0.043	0.040	478.333	7.500	8.600	0.004
5610	SEMINOLE RESERVOIR	0.030	0.130	447.000	2.536	11.000	0.007
5611	SODA LAKE	0.063	0.040	387.500	5.575	15.000	0.014
5612	VIVA NAUGHTON RESERVOIR	0.065	0.120	430.000	25.067	13.200	0.024
5613	WOODRUFF NARROWS RESERVO	0.069	0.105	470.000	12.950	13.200	0.019
5614	YELLOWTAIL RESERVOIR	0.026	0.310	364.500	5.410	10.000	0.017

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
5601	BIG SANDY RESERVOIR	0 (0)	54 (7)	0 (0)	77 (10)	77 (10)	8 (1)	216
5602	BOULDER LAKE	92 (12)	92 (11)	92 (12)	100 (13)	92 (12)	92 (12)	560
5603	BOYSEN RESERVOIR	46 (6)	23 (3)	23 (3)	46 (6)	8 (1)	42 (5)	188
5604	LAKE DE SMET	54 (7)	73 (9)	62 (8)	15 (2)	69 (9)	62 (8)	335
5605	FLAMING GORGE RESERVOIR	85 (11)	0 (0)	77 (10)	54 (7)	46 (6)	85 (11)	347
5606	FREMONT LAKE	100 (13)	73 (9)	100 (13)	85 (11)	100 (13)	100 (13)	558
5607	GLENDO RESERVOIR	31 (4)	8 (1)	31 (4)	23 (3)	38 (5)	42 (5)	173
5608	KEY HOLE RESERVOIR	69 (9)	62 (8)	38 (5)	31 (4)	15 (2)	69 (9)	284
5609	OCEAN LAKE	38 (5)	92 (11)	8 (1)	38 (5)	85 (11)	77 (10)	338
5610	SEMINOLE RESERVOIR	62 (8)	31 (4)	46 (6)	92 (12)	54 (7)	54 (7)	339
5611	SODA LAKE	23 (3)	92 (11)	69 (9)	62 (8)	0 (0)	31 (4)	277
5612	VIVA NAUGHTON RESERVOIR	15 (2)	38 (5)	54 (7)	0 (0)	27 (3)	0 (0)	134
5613	WOODRUFF NARROWS RESERVO	8 (1)	46 (6)	15 (2)	8 (1)	27 (3)	15 (2)	119
5614	YELLOWTAIL RESERVOIR	77 (10)	15 (2)	85 (11)	69 (9)	62 (8)	23 (3)	331

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	5602	BOULDER LAKE	560
2	5606	FREMONT LAKE	558
3	5605	FLAMING GORGE RESERVOIR	347
4	5610	SEMINOLE RESERVOIR	339
5	5609	OCEAN LAKE	338
6	5604	LAKE DE SMET	335
7	5614	YELLOWTAIL RESERVOIR	331
8	5608	KEY HOLE RESERVOIR	284
9	5611	SODA LAKE	277
10	5601	BIG SANDY RESERVOIR	216
11	5603	BOYSEN RESERVOIR	188
12	5607	GLENDO RESERVOIR	173
13	5612	VIVA NAUGHTON RESERVOIR	134
14	5613	WOODRUFF NARROWS RESERVO	119

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR WYOMING 08/05/76

LAKE CODE 5604 LAKE DESMET

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 25.9

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
5604A1	25.9	0.0	0.0	0.0	0.0	0.0	0.0	1.133	1.699	0.708	0.283	0.0	0.0	0.323
5604ZZ	25.9	0.057	0.085	0.085	0.113	0.425	0.708	0.142	0.085	0.085	0.085	0.085	0.057	0.167

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 25.9
SUM OF SUB-DRAINAGE AREAS = 25.9

TOTAL FLOW IN = 2.01
TOTAL FLOW OUT = 3.82

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
5604A1	10	74	0.028	5	0.028				
	11	74	0.0						
	12	74	0.028	4	0.028				
	1	75	0.142						
	2	75	0.425	23	0.425				
	3	75	0.425	23	0.425				
	4	75	0.425	13	0.425				
	5	75	0.425	18	0.283	27	0.425		
	6	75	0.425						
	7	75	0.283						
	8	75	2.124						
	9	75	1.416	28	0.566				
5604ZZ	10	74	0.085						
	11	74	0.085						
	12	74	0.057						
	1	75	0.057						
	2	75	0.085						
	3	75	0.085						
	4	75	0.113						
	5	75	0.425						
	6	75	0.708						
	7	75	0.142						
	8	75	0.085						
	9	75	0.085						

APPENDIX C
ATMO HOLF YRATURBIT

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/08/05

560402
44 28 54.0 106 45 18.0 3
LAKE DE SMET
56019 WYOMING

090291

11EPALES 2111202
0057 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/05/22	11	40 0000	7.7	9.8	138	557	8.60	171	0.020	0.600	0.020K	0.013
	11	40 0005	7.8	10.0		543	8.60	170	0.020	0.500	0.020K	0.012
	11	40 0020	7.3	9.4		540	8.60	170	0.020	0.600	0.020K	0.015
	11	40 0041	6.1	9.2		530	8.55	172	0.030	0.600	0.020K	0.013
	11	40 0054	6.1	9.4		531	8.55	170	0.030	0.700	0.020K	0.015
75/08/29	14	15 0000	20.2	7.8	60	724	8.55	164	0.020K	0.400	0.020K	0.010
	14	15 0005	20.3	8.0		725	8.60	162	0.020K	0.500	0.020K	0.009
	14	15 0015	19.5	7.4		718	8.50	164	0.020K	0.400	0.020K	0.011
	14	15 0033	19.0	5.6		713	8.40	164	0.040	0.400	0.020K	0.016
75/10/15	15	15 0000	12.6	8.6	96	631	8.60	175	0.030	0.400	0.020K	0.006
	15	15 0005	12.5	9.0		637	8.65	176	0.030	0.600	0.020K	0.006
	15	15 0015	12.3	8.2		632	8.60	164	0.030	0.500	0.020	0.004
	15	15 0035	12.2	8.2		628	8.60	160	0.040	0.400	0.020K	0.004
	15	15 0053	12.1	7.8		631	8.60	162	0.060	0.600	0.020K	0.004

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/05/22	11	40 0000	0.022	4.7	
	11	40 0005	0.029		
	11	40 0020	0.030		
	11	40 0041	0.037		
	11	40 0054	0.040		
75/08/29	14	15 0000	0.031	10.7	
	14	15 0005	0.035		
	14	15 0015	0.040		
	14	15 0033	0.030		
75/10/15	15	15 0000	0.035	16.0	
	15	15 0005	0.037		
	15	15 0015	0.049		
	15	15 0035	0.032		
	15	15 0053	0.070		

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/05

560401
44 27 40.0 106 44 17.0 3
LAKE DE SMET
56019 WYOMING

090291

11EPALES 2111202
0045 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/05/22	11	15 0000	7.7	9.4	132	560	8.60	169	0.020	0.600	0.020K	0.005
	11	15 0005	6.9	9.6		542	8.60	169	0.020K	0.500	0.020K	0.004
	11	15 0015	6.9	9.6		539	8.60	171	0.030	0.600	0.020K	0.009
	11	15 0025	6.8	9.4		539	8.60	170	0.030	0.600	0.020K	0.006
	11	15 0041	6.5	9.6		537	8.60	169	0.030	0.600	0.020K	0.013
75/08/29	16	30 0000	20.1	8.2	48	732	8.65	167	0.020K	0.400	0.020K	0.005
	16	30 0005	19.6	8.0		718	8.65	166	0.020K	0.400	0.020K	0.005
	16	30 0015	19.5	7.4		716	8.65	167	0.020	0.400	0.020K	0.006
	16	30 0031	19.0	5.8		712	8.40	170	0.060	0.400	0.020K	0.021
75/10/15	13	45 0000	12.5	10.0	72	629	8.65	161	0.020K	0.600	0.020K	0.004
	13	45 0005	12.4	9.2		624	8.65	164	0.020	0.600	0.020K	0.004
	13	45 0015	12.4	8.6		612	8.60	162	0.020	0.600	0.020K	0.003
	13	45 0038	12.3	8.6		633	8.65	163	0.030	0.600	0.020K	0.003

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCOT LT REMNING PERCENT
75/05/22	11	15 0000	0.026	4.8	
	11	15 0005	0.031		
	11	15 0015	0.030		
	11	15 0025	0.038		
	11	15 0041	0.037		
75/08/29	16	30 0000	0.031	9.4	
	16	30 0005	0.033		
	16	30 0015	0.027		
	16	30 0031	0.038		
75/10/15	13	45 0000	0.074	21.4	
	13	45 0005	0.039		
	13	45 0015	0.033		
	13	45 0038	0.026		

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 76/08/05

S604A1
44 31 00.0 106 46 50.0 4
PINEY CREEK
56 7.5 BANNER
O/LAKE DE SMET 090291
BRDG ON LOTY PAVED RD 16 MI NW BUFFALO
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/10/05	15 10		0.016	2.100	0.035	0.010	0.055
74/12/04	15 00		0.136	1.300	0.165	0.015	0.120
75/02/23	12 45		0.151	1.580	0.144	0.024	0.300
75/03/23	12 55			0.550	0.015	0.015	0.080
75/04/13	09 00		0.220	0.700	0.060	0.015	0.050
75/05/18	08 30		0.680	0.250	0.065	0.075	0.080
75/05/27	10 15		0.025	0.450	0.015	0.015	0.070
75/09/28	16 00		0.005	0.600	0.015	0.005	0.050

ATAD YHATUBIRT E AZUMERDA

STORET RETRIEVAL DATE 76/08/05

3604C1
44 30 20.0 106 46 30.0 4
SHELL CREEK
56 7.5 BANNER
T/LAKE DE SMET 090291
300 FT FROM GRAVEL RD 17.3 MI NW BUFFALO
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/10/05	16 00		0.008	1.400	0.035	0.025	0.080
74/12/04	14 30		0.104	0.500	0.030	0.010	0.020
75/01/02	14 00		0.224	0.500	0.056	0.025	0.050
75/02/23	12 35		0.220	2.900	0.072	0.072	0.440
75/03/23	12 40		0.055	0.850	0.040	0.045	0.100
75/04/13	08 30		0.140	1.350	0.090	0.045	0.090
75/05/18	09 15		0.005	0.400	0.025	0.035	0.070
75/05/27	10 30		0.010	2.000	0.035	0.025	0.080
75/09/28	14 30		0.005	0.400	0.012	0.020	0.060

STORET RETRIEVAL DATE 76/08/05

5604dl
44 31 40.0 106 48 15.0 4
LITTLE PINEY CREEK
56 7.5 BANNER
T/LAKE DE SMET 090291
BNK 50 FT N OF RD .7 MI SW OF KEARNY
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
75/05/13	09 45		0.055	0.950	0.095		0.020
75/09/28	15 00		0.005	0.350	0.015	0.010	0.030